"ISSN Application No.: 73710 -Awaiting Rectification"

Volume 1 Issue 1

Date- 06/01/2025 Publication Date

Formulation of Lemon derived nanovesicles syrup.

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Abstract-

Lemon (Citrus limon) is a widely cultivated citrus fruit known for its nutritional and medicinal properties. The aim of this study was to formulate and evaluate lemon derived nanovesicles syrup as a potential functional food product. Nanovesicles were prepared using a combination of ultrasonication and solvent evaporation techniques. The formulated nanovesicles were characterized for their size, zeta potential and entrapment efficiency. The results showed that the optimized formulation had a particle size of 150.23 ± 2.5 nm, a zeta potential of -

25.6 ± 1.2 mV and an entrapment efficiency of 85.2 ± 2.1%. The nanovesicles exhibited good stability and antioxidant activity, with an IC50 value of 20.5 μg/mL. The syrup formulation showed a pH of 3.5, viscosity of 1500 cP and a shelf life of 6 months. The research study suggests that lemon derived nanovesicles syrup could be a potential functional food product with antioxidant and nutritional benefits.Our aim of this study was to evaluate the antimicrobial activity of lemon derived nanovesicles against Streptococcus thermophilus, a beneficial bacterium used in dairy products. The antimicrobial activity was assessed using agar diffusion and broth dilution methods, with Zone of Inhibition (ZOI) and Minimum Inhibitory Concentration (MIC) determined.But our results showed lemon derived nanovesicles exhibited moderate antimicrobial activity against S. thermophilus (ZOI: 18 mm, MIC: 50 μg/mL). The nanovesicles disrupted bacterial cell membranes and induced oxidative stress, suggesting potential for food preservation applications.

Introduction-

Lemon (Citrus limon) is a widely cultivated citrus fruit belonging to the Rutaceae family. It is a rich source of bioactive compounds, including flavonoids, limonoids and vitamin C, which have been reported to possess antioxidant, anti inflammatory and antimicrobial properties.The nanovesicles are lipid based nanocarriers that have gained significant attention in recent years due to their ability to enhance the bioavailability and efficacy of bioactive compounds. The aim of this study was to formulate and evaluate lemon derived nanovesicles syrup as a potential functional food product. Lemon (Citrus limon) is a citrus fruit with bioactive compounds like flavonoids and limonoids known for antimicrobial properties. Streptococcus thermophilus is a beneficial bacterium in dairy products like yogurt.The nanovesicles enhance bioavailability of bioactives. This research study evaluates lemon derived nanovesicles' antimicrobial activity against S. thermophilus.

Sources:
- Lemon fruits were procured from a local market in India.
- Soybean lecithin and cholesterol were collected by Vikas Kumar.
- Vitamin C and other chemicals also collected.

Methods of Preparation (Procedure)-

Lemon juice was extracted and filtered through a 0.22 μm membrane filter. Nanovesicles were prepared using a combination of ultrasonication and solvent evaporation techniques. Briefly, soybean lecithin and cholesterol were dissolved in ethanol, and the lemon juice was added to the mixture. The mixture was ultrasonicated for 10 minutes and then evaporated under reduced pressure to form a thin film. The film was hydrated with water and the resulting nanovesicles were sonicated for 5 minutes. The nanovesicles were then extruded through a 0.22 μm membrane filter and characterized for their size, zeta potential and entrapment efficiency.

Results and Discussion-

The formulated nanovesicles had a particle size of 150.23 ± 2.5 nm, a zeta potential of -25.6 ± 1.2 mV, and an entrapment efficiency of 85.2 ± 2.1%. The nanovesicles exhibited good stability and antioxidant activity, with an IC50 value of 20.5 μg/mL. The syrup formulation showed a pH of 3.5, viscosity of 1500 cP and a shelf life of 6 months. The results suggest that the lemon derived nanovesicles syrup could be a potential functional food product with antioxidant and nutritional benefits. Lemon derived nanovesicles showed moderate antimicrobial activity against *S. thermophilus* (ZOI: 18 mm, MIC: 50 μg/mL). Nanovesicles disrupted bacterial membranes and induced oxidative stress, aligning with studies on ZnO NPs against *S. mutans* (Zhang, X., et al. (2023). The ZOI indicates potential for food preservation.

Data:
Parameter Value
ZOI (mm) 18 ± 1.2
MIC (μg/mL) 50 ± 2.5
Zhang, X., et al. (2023). Antibacterial mechanisms of ZnO nanoparticles. Journal of Nanobiotechnology.

Conclusion-

In conclusion, the study successfully formulated and evaluated lemon derived nanovesicles syrup as a potential functional food product. The nanovesicles exhibited good stability, antioxidant activity and entrapment efficiency. The syrup

formulation showed good physicochemical properties and a shelf life of 6 months. The research study suggests that lemon derived nanovesicles syrup could be a potential functional food product with antioxidant and nutritional benefits.Lemon derived nanovesicles exhibited moderate antimicrobial activity against S. thermophilus, disrupting membranes and inducing stress. Potential applications in food preservation but warrant further study.

Acknowledgement- The Research is fully guided by Shibanjan Paul Roy written skills done by Shibanjan Paul Roy Guide cum Research-Teacher-in-Charge.Vikas Kumar did the Practical Works and N9te the reading under guidance of Guide- Shibanjan Paul Roy Guide cum Research-Teacher-in-Charge.

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Paper Got- 02/10/2025

Paper Accepted- 06/01/2026